AMKOR TECHNOLOGY DISCLOSURE FORM
Patent Tracking # 2K1039

The purpose of this form is to secure the disclosure and record date of your invention. In accordance with the Amkor Patent Awards Policy, the Amkor Technology Disclosure Form must be filled out as thoroughly as possible and filed with the Amkor Patent Review Board. A separate form must be used for each invention or modification of the invention and each sheet should be signed and dated by the inventor and also signed and dated by two witnesses, by whom the contents of the disclosure have been read and understood.

All the following entries should be made in ink or typed, without excessive erasures or the use of "liquid paper".

I. Give a descriptive Title of the invention

Raised Lead Frame Feature for MLF Packages

II. Give a clear and detailed statement explaining the Invention (Use the space below for a sketch showing the important components of the invention with numbers to identify each component, which can be referred to in the description. If the invention is electrical, use appropriate block or circuit diagrams; if chemical, include formulas. If the invention is a process, show a flow diagram.)

If the space provided is inadequate, attach separate diagrams, schematics, reports, drawings or prints and description (properly signed, witnessed and dated if possible).

The Raised Lead Frame (LF) features shown in the sketch are formed during the Lead Frame process, which forms the Wire Bond area.

Raised inner lead tip Raised GND ring

III. Background information on the invention:

MLF Packages have the same historic issue with ground/down bond reliability as the ePad Packages. This down/ground bond reliability issue is a result of delamination. Severe delamination typically occurs at the interfaces that depend solely on adhesion between the LF and the mold compound.

A. What are the objects or purpose of the invention?

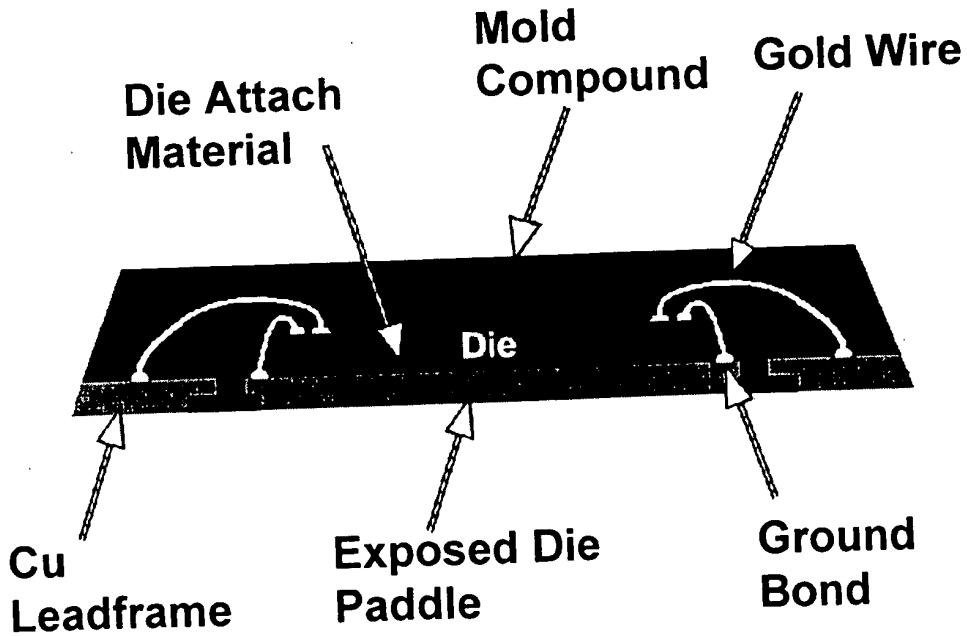
To eliminate the ground/down bond reliability issue due to adhesion, by moving the wire bond surfaces up into the plastic.

B. What problem(s) are solved by the invention?

By having the wire bond surfaces up in the plastic, the wires are now "mechanically" captured. By surrounding the wires with plastic in this fashion, the delamination separation impact on the ground/down bonds is nullified.

C. What were the previous methods or apparatus that were used but failed to solve the problem? (Give sources of previous information on the subject that is closest to your inventions, such as known use, publications or patents).

The existing Lead Frame design has the die paddle and inner lead tips coplanar as shown below:



D. State how the present invention differs from previous methods or apparatus and what advantages it provides.

The invention consists of:
1) Raised die paddle Wire Bond ring
2) Raised inner lead tips for Wire Bond

IV. What is the prospective value or utility of the invention for Amkor Technology?

Provides a competitive advantage since the majority of the MLF customers require ground/down bonding. To date, we do not have a generic robust solution.

V. Give the Project No. which covers the work done, if any, and identify any monthly or other issued reports or documentation.

See Appendix A.

VI. Has information, samples or technical bulletins relating to this invention been given to customers, vendors or other third parties. If the answer is yes, what, when and to who was the information or samples given?

No

VII. When did you first think of this invention?

March 2nd, 2001

VIII. What records do you have to substantiate this conception date? (Engineering Notebook numbers and pages, letter(s), report(s), etc.) What is the date of the first written description and / or drawing?

Engineering Notebook #105, page 5 (see Appendix B)

IX. When did you first do any actual experimental work toward carrying out the invention?

Date: Dec 2000 (see Appendix A for ePad summary data)

Engineering Notebook No. _____

Page(s)_____

X. Have any prototypes or samples been produced? If yes, when were they completed?

No, not of the MLF package.

XI. When and how did you make the first disclosure of this invention to others either orally or in writing?

2 Mar 2001 to Thun Kham via Engineering Notebook witness

XII. Has any pertinent information been disclosed to others outside the company (e.g. samples, notes, drawings, and descriptions)? If the answer is yes, what, when and to who was the information or samples given?

No

XIII. Give the date and description of past or future publications.

None

XIV. Is further experimental work now under way or contemplated for the near future? If so, give a general summary of such work and some idea of when this phase of the program will be completed.

Not at this time.

XV. Was this invention developed under a Government Contract? If yes, give the contract number?

No

XVI. Has products relating to this invention been sold, or has the process involved been used on a commercial sale? If the answer is yes, what, when and to whom were they sold?

No

XVII. Patent Searching:

1. Sources used:

US Patent Office Search

2. Key Words used in the search

Electronics, QFN, exposed pad, thermally enhanced

3. Patents that apply to this submission

If necessary, attach additional pages.

XVIII Furnish the following information for each inventor:

1. Name in Full___Jeffrey Alan Miks_____
   Company Title____ATI_____
   Citizenship_____US_____
   Home Address___431 N Kenneth Pl_____
   City, County and State: ____Chandler, AZ_____
   Supervisor: ____Joan McDermott_____
   Contribution: (Attach additional pages, as necessary)
   Signature of Inventor_____
   Dated: 3/9/01

WITNESSES: (2 required)

READ AND UNDERSTOOD BY:

WITNESS: _____ DATED: 03/13/01

WITNESS: _____ DATED: 3/13/01

Reviewed By: _____ DATED: 3/13/01
(Department Head)

Mb:amkortechnologydisclosureform.doc

Definition of the Problem

- **MLF Packages have the same historic issue with ground/down bond reliability as the ePad Packages**
  - down/ground bond reliability issue is a result of top-of-die pad delamination
  - severe delamination typically occurs at the interfaces that depend solely on adhesion between the LF and the mold compound

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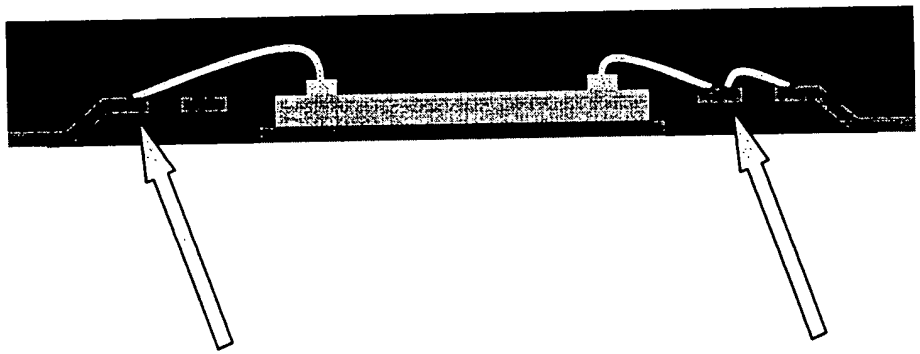
Raised Lead Frame Feature for MLF Packages

- **Solution: limit the delamination gap separation**
  - surrounding the critical W/B locations in mold compound



Raised inner lead tip Raised GND ring

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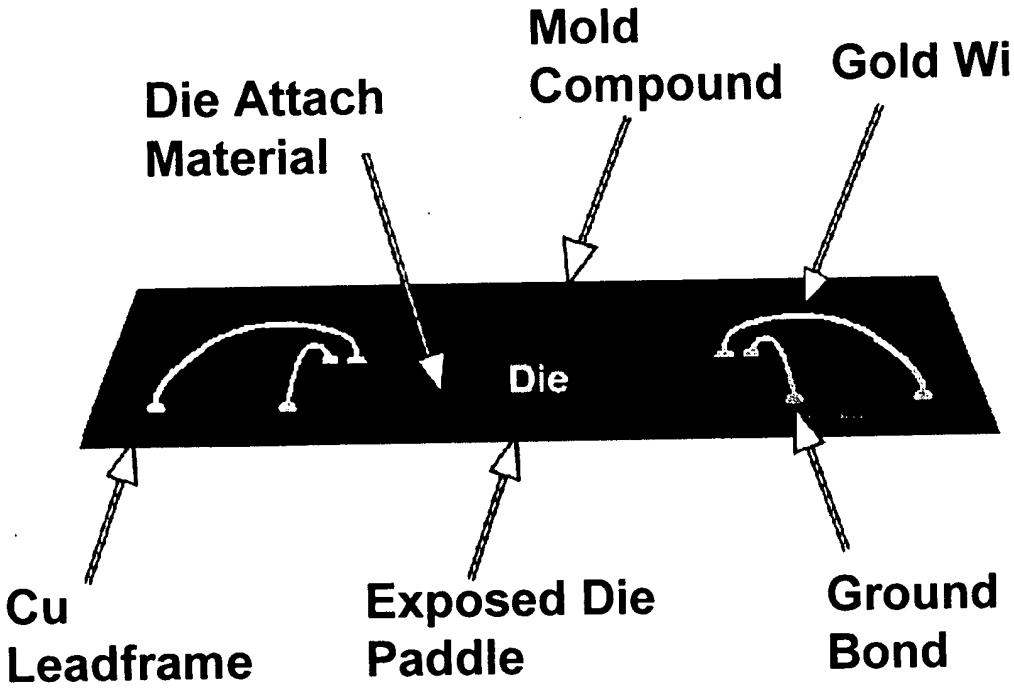
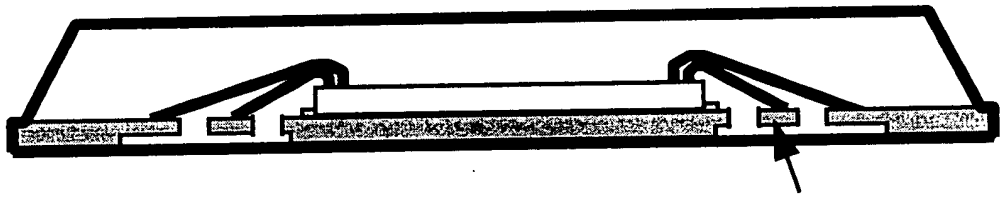
Prior Art



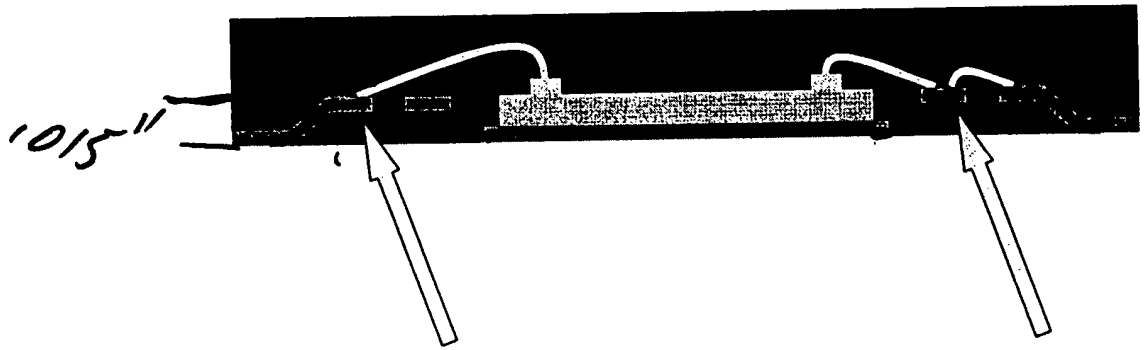


Ring for down bond

What is the Invention?

1) Raised die paddle Wire Bond ring

2) Raised inner lead tips for Wire Bond



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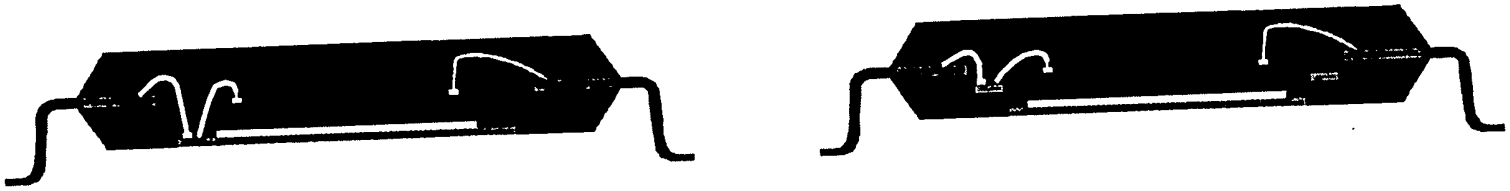
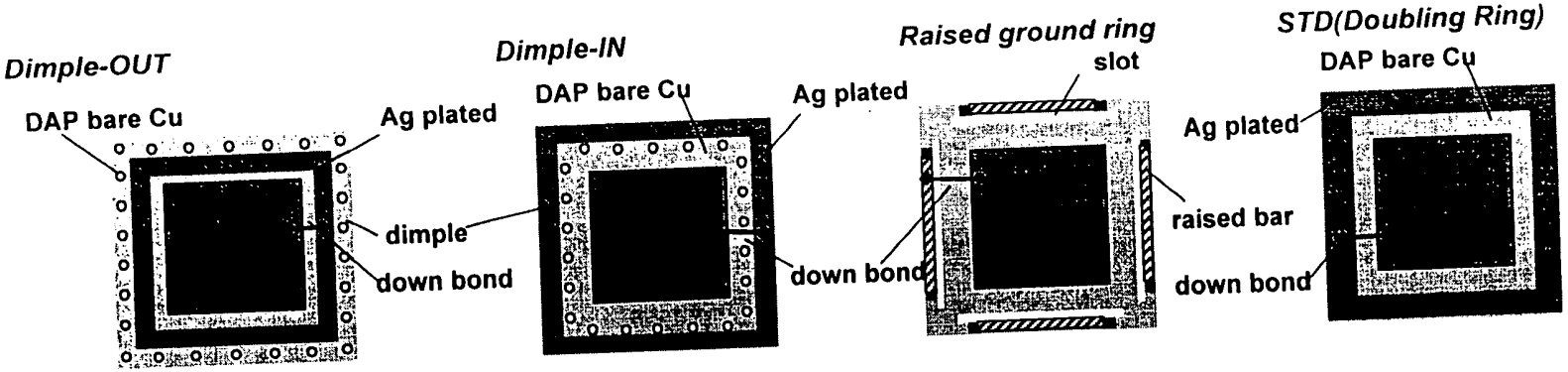
Solution

- **By having the wire bond surfaces up in the mold compound, the wires are now "mechanically" captured**
- **By surrounding the wires with mold compound in this fashion, the delamination separation impact on the ground/down bonds is nullified**
  - similar to the inner leads delam (Type IV) we see on all LF products

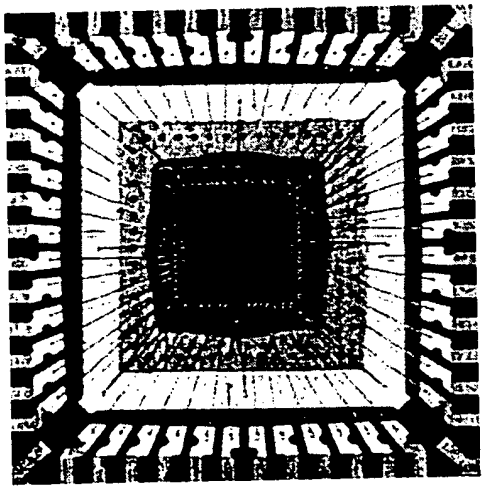
Back-up Data

- ePad TQFP LF Designs that were evaluated:

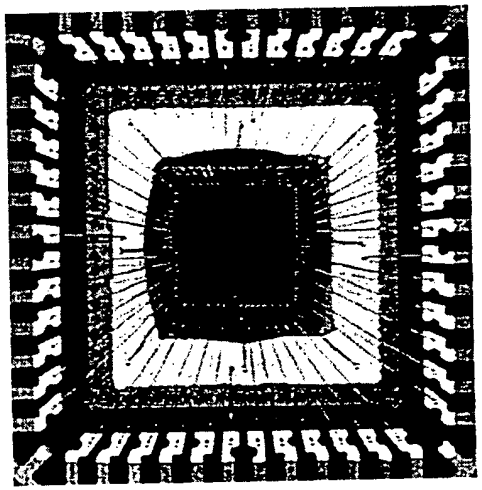




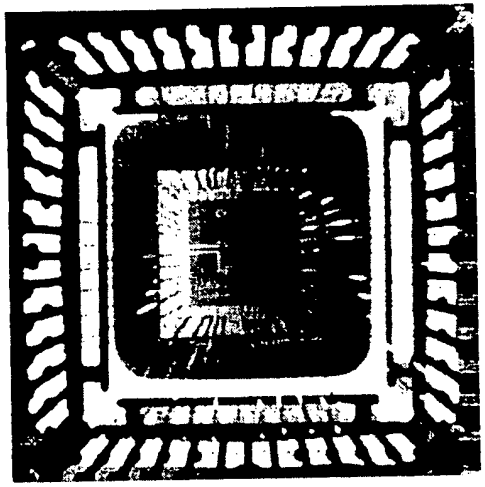
Back-up Data



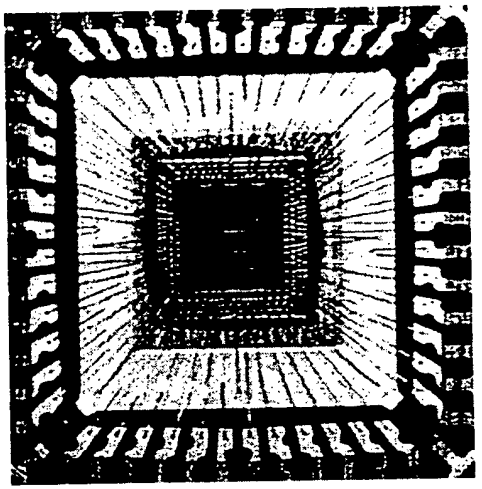
DIMPLE IN



DIMPLE OUT



RAISED RING



STANDARD

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Back-up Data

- 10x10mm ePad TQFP with raised ring design was the only design that passed 1000 T/C
- all 7x7mm ePad TQFP designs passed, but only the raised ring had zero delam

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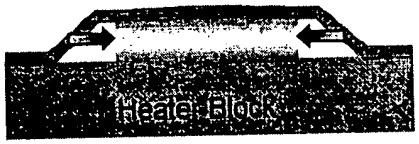
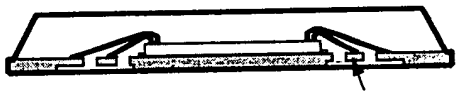
Additional Back-up Data at 260°C

- passed long term reliability (1000 T/C) at L3@260'C
  - **ePad TQFP**
    - Eliminate electrolytic deflash process
    - Develop raised ring L/F design
      - **D/A : 8361J**
      - **EMC : 7351UL**
      - **L/F : Raised ring**



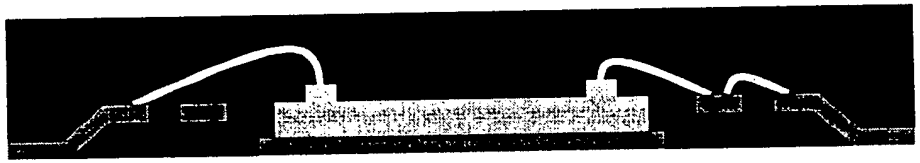
  - **MLF**
    - Eliminate electrolytic deflash process
    - Develop locking hole design L/F
      - **D/A : 8290**
      - **EMC : G700**
      - **L/F : Type 1 Locking ring**



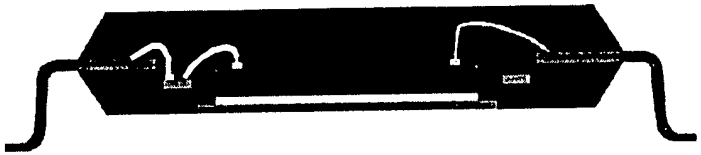
Ring for down bond

Summary

- **Etched or Stamped LF solution**
  - Raised die paddle Wire Bond ring
  - Raised inner lead tips for Wire Bond
  - enables the use of thinner LF material
    - benefits SAW singulate?



- **Benefit for Amkor to Patent**
  - keep our competitors from using this technique to solve the delam problem
    - e.g. Cirrus 208 ePad LQFP DDS-ring



      - ASE has not been able to solve their delam issue
        - generated $15kk revenue YTD because of the Amkor solution

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